NAVAIR Requirements and Status of Cadmium Alternatives

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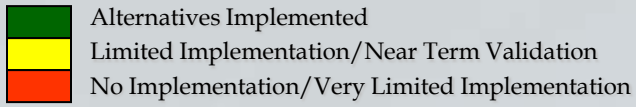
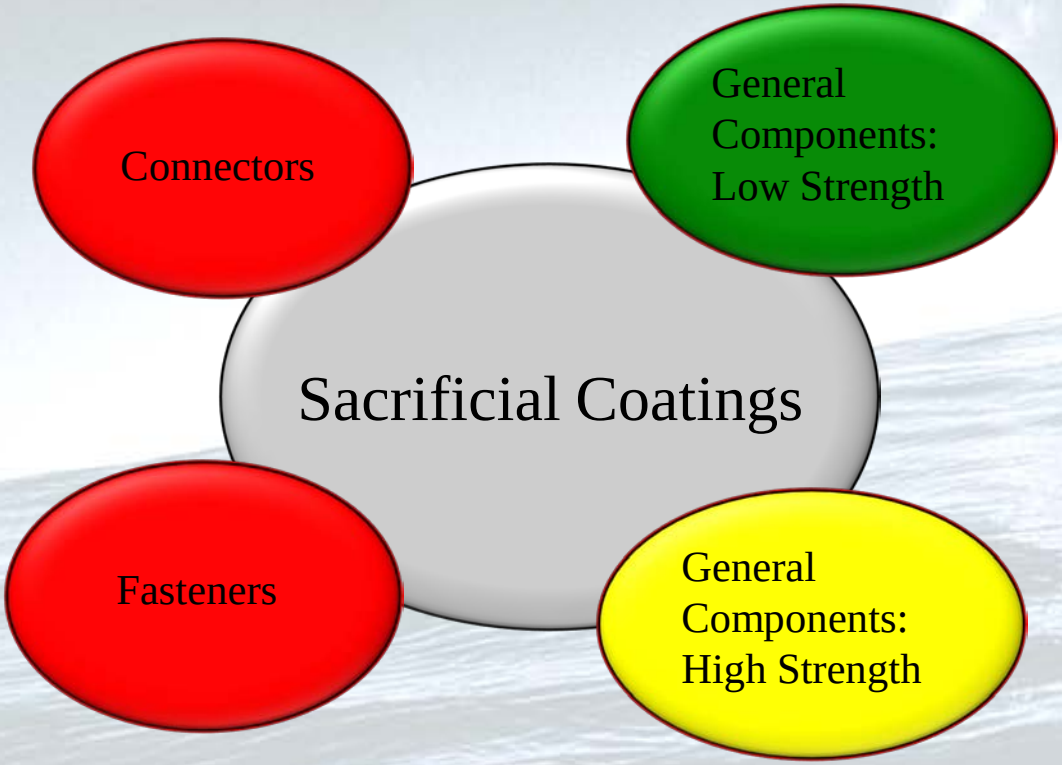
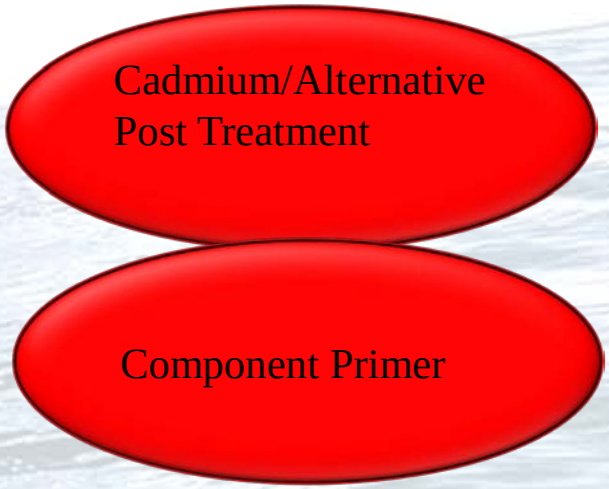
NAVAIR Application Areas for Sacrificial Coatings





Linked Coating System Issue: Cr^{6+}



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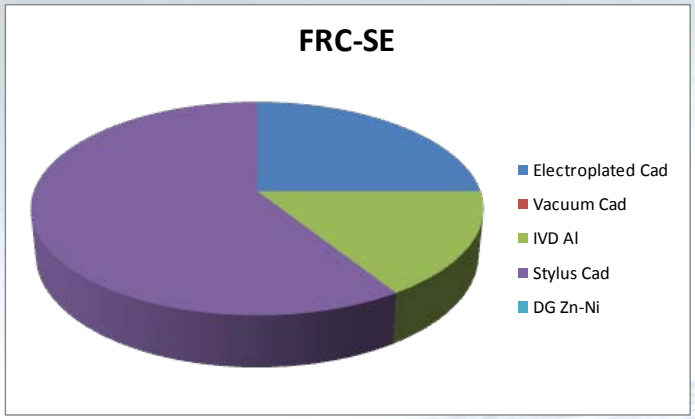
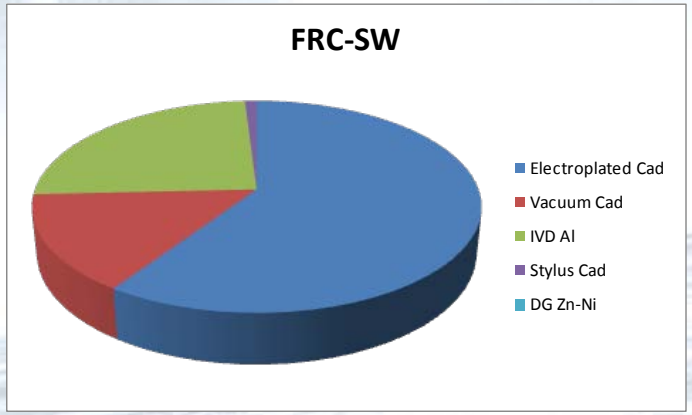
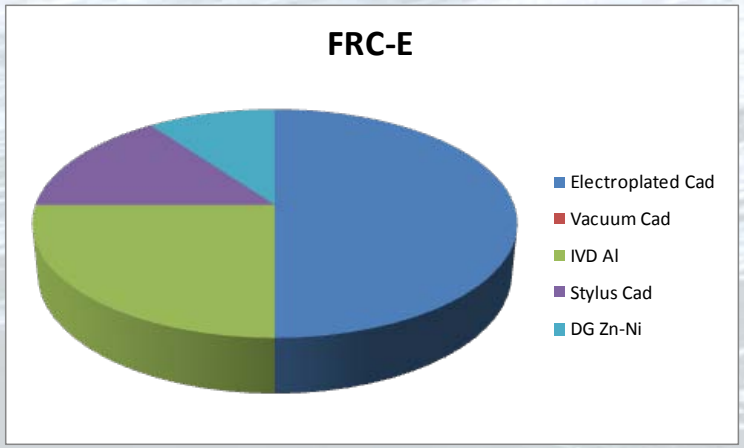
Current NAVAIR Capabilities for Implemented Sacrificial Coating Processes

2010 Estimated Workload, % of total component work orders







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Status for Various Coatings and Processes

Coating/Process	Advantage	Disadvantage	LS Components	HS Components	Connectors	Fasteners
Electroplated cadmium	easy, sunk cost	it's cadmium	yes	yes	yes	yes
Vacuum cadmium	no post bake	it's cadmium, line-of-sight	yes	yes	yes	yes
IVD aluminum	it's not cadmium, no post bake	expensive process	yes	yes	yes	no
Alkaline zinc-nickel	it's not cadmium, low cost process	limited application due to HE	yes	no	yes	no
Stylus cadmium	sunk cost, established	it's cadmium, artisan required	yes	yes	NA	NA
AlumiPlate	it's not cadmium, non-LOS process	process, sole source	yes	yes	yes	yes
IZ-C17+ zinc-nickel	it's not cadmium, low cost process	post bake required, in dem/val	yes	yes	yes	yes
Cold spray aluminum	novel process to apply aluminum	line-of-sight	yes	yes	no	no

Focusing on two alternative metals/alloys, aluminum and zinc-nickel, reduces the number of galvanic interactions possible and lowers the cost of testing, validation and implementation

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Implementation Plan for Alternatives on Components

- Low strength steel and other substrates
  - Rolling implementation of IVD Al (since ~1985) and alkaline ZnNi (since 2003) on legacy platforms and in new design
- High strength steels
  - IVD aluminum (also used on aluminum alloys)
  - AlumiPlate (recently authorized)
- New coatings/processes for low and high strength steels
  - IZ-C17+ Zinc-Nickel (pending successful demonstration and validation)
    - Targeted at remaining tank-based cadmium applications not possible with IVD Al or Alumiplate
    - Targeted at current IVD aluminum applications where electroplated coating is less expensive and faster
  - Cold Spray Aluminum- for new deposition and repair
    - Potential use on steel, aluminum and other surfaces

Implementation Plan for Alternatives on Components

- Connectors
  - Coordinate assessments with avionics department and other services
  - Complete assessment of multiple alternatives on electrical connectors and fiber optic connectors
  - No clear outcome so far
- Fasteners
  - Implement barrier coatings (Sermetel, etc.) and zinc-alloys on low strength fasteners
  - Implement CRES and Ti where business case allows
    - Issue: recent galvanic testing has shown poor relative performance of CRES in aluminum alloys compared to Ti- reflects field performance
    - These relatively cathodic metals still require sacrificial coating for galvanic protection and paint/sealant adhesion, where required
  - Assess IZ-C17+ for HS fasteners once process validated for components

General NAVAIR Requirements for New Coating or Process Implementation

- Implementation Path
  - Lab validation of product/process and coating performance
  - Field validation of product/process and coating of performance
  - Implementation
    - Sign-off
      - Pax: Materials (Structures, Subsystems, Systems, Aeromechanics if necessary)
      - FRC/ISSC: Materials
      - Program: FST/Class Desk/OEM
    - Revise specs (local/MIL/AMS…)
    - Revise NAVAIR "509 & 540" Corrosion Control Manuals via Interim Rapid Action Change or "IRAC"

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General NAVAIR Requirements for New Coating or Process Implementation

- Non-Critical Application Test Criteria
  - Per Milspec and other NAVAIR screening tests
  - Field Testing: 2-year in-service with 2 carrier/ship deployments on a minimum of 2 vehicles- same or better performance compared to controls
- Critical Application Test Criteria
  - Per Milspec or other NAVAIR screening tests
  - Fatigue/other critical lab/component tests per application
  - Flight clearance depending on component/risk
  - Field Testing: requirement depending on component per Air Vehicle Divisions
    - Materials, Structures, Subsystems, Systems
    - Will be more stringent validation path than for non-critical applications: longer road, more expensive, more sensitive

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Implementation Barriers

✈ Galvanic interaction of alternatives (including hexavalent chromium alternatives, i.e. coating system impact)- especially important for connectors

✈ Impact of Cr6+ on sacrificial coating performance- passivation, primer

✈ Sacrificial coating passivation required- current authorized passivations use Cr^{6+} (except MIL-DTL-81706 Type II (TCP) authorized on Alumiplate)

✈ Primer required on most component surfaces- current authorized primer is MIL-PRF-23377 Class C (chromate)

✈ FRCs/ISSCs do not rework connectors and fasteners- transition path is through suppliers, OEMS, and subcontractors

Summary

✈ Cadmium use already reduced to approximately 75% of total work at FRCs

✈ Remaining use of cadmium at FRCs targeted to be replaced by increased use of IVD Al and new use of IZ-C17+ zinc-nickel and cold spray aluminum

✈ Transition at FRCs will continue on a rolling basis and be based on cost-benefit for each application, as determined by platform FSTs

✈Alternatives will continue to be implemented on new weapon systems during design process

✈ Connector and fastener implementation is driven by OEMs and subcontractors and will be most effectively completed during new design, as NAVAIR has limited leverage into fastener and connector specifications, and does not repair these types of components